

WHAT IS CLAIMED IS:

1 1. A head driving apparatus, incorporated in an ink jet printer which
2 comprises:

3 a print head, provided with a plurality of nozzles;
4 piezoelectric elements, each associated with one of the nozzles and
5 provided with a drive electrode and a common electrode; and

6 a head driver, which generates a drive signal for driving the piezoelectric
7 elements, and selectively supplies the drive signal to at least one of the
8 piezoelectric elements to eject an ink droplet from at least one associated
9 nozzle, the head driving apparatus comprising:

10 a bias power source, which applies a bias voltage having a
11 predetermined potential to the common electrode of each piezoelectric
12 element.

1 2. The head driving apparatus as set forth in claim 1, wherein the
2 potential of the bias voltage is variable.

1 3. The head driving apparatus as set forth in claim 1, wherein the bias
2 power source is provided as a logic power source.

1 4. The head driving apparatus as set forth in claim 1, wherein the bias
2 power source generates the bias voltage based on a power supplied from a
3 power source for driving the print head.

1 5. The head driving apparatus as set forth in claim 4, wherein the bias
2 power source includes:

3 a condenser, electrically connected to the common electrode; and

4 a constant-voltage circuit, which applies the bias voltage to the
5 condenser.

1 6. The head driving apparatus as set forth in claim 5, wherein:

2 the constant-voltage circuit includes a Zener diode, a current limiting
3 resistance and a coupling element;

4 the Zener diode is electrically connected to the head driving power
5 source through the current limiting resistance; and

6 the Zener diode is electrically connected to the common electrode
7 through the coupling element.

1 7. The head driving apparatus as set forth in claim 6, wherein the
2 constant-voltage circuit includes a discharging diode electrically connected to
3 the head driving power source in parallel with the current limiting resistance,
4 such that a current is flowed to the head driving power source through the
5 discharging diode.

1 8. The head driving apparatus as set forth in claim 1, wherein the bias
2 power source includes:

3 a first condenser, electrically connected to the common electrode; and

4 a charger, which charges the first condenser with electric charges
5 discharged from the piezoelectric elements.

1 9. The head driving apparatus as set forth in claim 8, wherein the charger
2 includes a second condenser charged with the electric charges.

1 10. The head driving apparatus as set forth in claim 9, wherein the charger
2 includes a constant-voltage circuit which regulates a charged voltage of the
3 second condenser, and applies the charged voltage to the first condenser.

1 11. The head driving apparatus as set forth in claim 9, wherein the second
2 condenser is charged before a printing operation is performed.

1 12. The head driving apparatus as set forth in claim 1, wherein:
2 the bias power source includes:
3 a condenser, which apply the bias voltage to the common
4 electrode; and
5 a charger, which charges the condenser based on a power
6 supplied from a power source for driving the print head; and
7 the bias voltage is substantially identical with an intermediate potential
8 of the drive signal.

1 13. The head driving apparatus as set forth in claim 12, wherein the
2 charger includes a switcher, which applies the intermediate potential to the
3 condenser when the drive signal is not used for ejecting the ink drop.

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1 14. The head driving apparatus as set forth in claim 13, wherein the
2 switcher is provided as a switching element.

1 15. The head driving apparatus as set forth in claim 13, wherein the
2 switcher is controlled in accordance with the drive signal.

1 16. The head driving apparatus as set forth in claim 1, wherein the bias
2 power source is provided as a reference voltage generator which applies a
3 reference voltage having a potential which is substantially identical with an
4 intermediate potential of the drive signal, to the common electrode.

1 17. The head driving apparatus as set forth in claim 16, further comprising
2 a charger which generates a charge signal for charging at least one of the
3 piezoelectric elements when the drive signal is not used for ejecting the ink
4 drop,

5 wherein the reference voltage generator includes:

6 a voltage holder, which latches an arbitrary potential of the drive
7 signal based on the charge signal; and

8 an current amplifier, which current-amplifies a voltage output from the
9 voltage holder.

1 18. The head driving apparatus as set forth in claim 16, wherein:
2 the reference voltage generator discharges at least one of the
3 piezoelectric elements when a potential of the drive signal is higher than the
4 intermediate potential while a printing operation is performed; and

the reference voltage generator charges at least one of the piezoelectric elements when the potential of the drive signal is lower than the intermediate potential while the printing operation is performed.

19. The head driving apparatus as set forth in claim 17, wherein the reference voltage is applied when the charger charges the at least one of the piezoelectric elements, based on the output voltage of the voltage holder.

20. The head driving apparatus as set forth in claim 18, wherein the reference voltage generator includes a discharger which discharges at least one of the piezoelectric elements.

21. A liquid jetting apparatus, comprising:
a jetting head, provided with a plurality of nozzles;
piezoelectric elements, each associated with one of the nozzles and provided with a drive electrode and a common electrode; and
the head driving apparatus as set forth in any one of claims 1-20.

22. A method of driving a jetting head in a liquid jetting apparatus, comprising the steps of:
providing a liquid jetting apparatus which comprises:
a jetting head, provided with a plurality of nozzles;
piezoelectric elements, each associated with one of the nozzles and provided with a drive electrode and a common electrode; and
a head driver, which generates a drive signal for driving the

8 piezoelectric elements, and selectively supplies the drive signal to at least one
9 of the piezoelectric elements to eject an ink droplet from at least one
10 associated nozzle;

11 providing a bias power source in the liquid jetting apparatus; and
12 applying a bias voltage having a predetermined potential from the bias
13 power source to the common electrode of each piezoelectric element.

1 23. The head driving method as set forth in claim 22, further comprising
2 the step of charging at least one of piezoelectric elements when the drive
3 signal is not used for ejecting the ink drop.

1 24. The head driving method as set forth in claim 22, further comprising
2 the steps of:

3 determining a reference potential in the drive signal;
4 discharging at least one of the piezoelectric elements when a potential
5 of the drive signal is higher than the reference potential while a printing
6 operation is performed; and
7 charging at least one of the piezoelectric elements when the potential
8 of the drive signal is lower than the reference potential while the printing
9 operation is performed.

1 25. The head driving method as set forth in claim 22, further comprising
2 the step of varying a potential of the bias voltage so as to follow a potential of
3 the drive signal when the drive signal is not used for ejecting the ink drops.

- 1 26. The driving method as set forth in claim 22, further comprising the
2 steps of:
3 determining a reference potential as an intermediate potential of the
4 drive signal; and
5 adjusting the bias voltage based on the reference potential.

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